

REMARKS

Applicants appreciate the thorough examination of the present application that is reflected in the Official Action of August 12, 2004. In response, independent Claims 1 and 11 have been amended to clarify the patentable distinctions over U.S. Patent 6,531,377 to Knorr et al., taken alone or in combination with the secondary reference(s). The reasons for patentability will be described in more detail below.

Affirmation of Election

Applicants hereby affirm the provisional election of Claims 1-6 and 11-20, without traverse. Claims 7-10 have been canceled without prejudice to the filing of a divisional application. Moreover, the title has been changed to conform to the elected device claims.

Request for Issuance of Corrected Filing Receipt

On September 17, 2003, Applicants filed a "Petition To Accord A Proper Filing Date" for the above-identified application, which petitioned to grant the proper filing date of June 23, 2003, rather than June 24, 2003. On October 21, 2003, this petition was granted, as shown in the attached "Decision Granting Petition". Yet, a corrected Filing Receipt has never been issued, and the Official Action cover sheet still indicates the improper filing date of June 24, 2003. Accordingly, Applicants respectfully request issuance of a corrected Filing Receipt pursuant to the "Decision Granting Petition".

Claims 1 and 4-6 Are Patentable

Claims 1 and 4-6 were rejected under 35 USC §102(e) as being anticipated by Knorr et al. Independent Claim 1 has been amended to further define the grooves, and thereby further clarify the patentable distinction over Knorr et al. In particular, amended Claim 1 recites:

1. A method of forming a trench isolated integrated circuit device comprising:
forming a trench including sidewalls in an integrated circuit substrate;
forming a lower device isolation layer in the trench and extending onto the trench sidewalls, the lower device isolation

layer including long, narrow grooves therein, a respective one of which extends along a respective one of the sidewalls, such that a respective groove spaces apart the lower device isolation layer adjacent thereto, from a respective sidewall; and

forming an upper device isolation layer on the lower device isolation layer and in the grooves. (Emphasis added.)

Knorr et al. does not describe the formation of long, narrow grooves that extend along the sidewalls such that a groove spaces apart the lower device isolation layer adjacent thereto from a respective sidewall. In this regard, the Official Action cites Knorr et al. Column 4, lines 10-63, as describing the formation of grooves. However, Knorr et al. Column 4, lines 44-52 states:

The wafer **100** is exposed to an isotropic etch to remove the first insulating material **116** from at least the sides of the isolation trenches **111**, as shown in FIG. 4. Although a small portion of first insulating material may be removed by the isotropic etch from the top surfaces of the wafer **100** and top surface of the first insulating material **116** within the trench, a portion of the first insulating material **116** remains residing within the bottom of the isolation trenches **111** and over the top of the pad nitride **114**.

As described above, and as clearly shown in Knorr et al. Figure 4, upon etching of the first insulating material **116** of Figure 3, two widely spaced apart regions of the insulating material are formed. A first region is contained within the bottom of the trench, and a second region is contained on the face of the substrate. These two regions are widely spaced apart from one another, and do not define any long, narrow grooves, wherein a groove spaces apart the lower device isolation layer adjacent thereto from a respective sidewall. Accordingly, the recitations of amended Claim 1 are not described or suggested. Moreover, it would not be obvious to provide grooves based upon the disclosure of Knorr et al. of etching the first insulating material **116** from the sides of the isolation trenches. Accordingly, Claim 1 is patentable, and Claims 4-6 are patentable at least per the patentability of Claim 1 from which they depend.

Claims 2, 3, 11-13, 15, 16 and 20 Are Patentable Over Knorr et al. In View of Chen et al.

Independent Claim 11 is patentable for at least the reasons that were described above in connection with independent Claim 1. Moreover, Applicants respectfully

submit that it would not be obvious to substitute Chen et al. into Knorr et al., because the above-cited paragraph of Knorr et al. clearly describes isotropic etching to remove the first insulating material **116** from at least the sides of the isolation trenches, to thereby form two separated areas of the insulating material at the bottom of the trenches and over the top of the pad nitride. There is no description or suggestion that this isotropic etching could somehow form long, narrow grooves within the trench, as recited in Claim 11, nor would this isotropic etching be expected to do so. Accordingly, assuming for the sake of argument that Chen et al. described or suggested grooves, there would be no motivation to substitute Chen et al. into Knorr et al. to contradict the explicit teachings of Knorr et al. Accordingly, Claim 11 is patentable over Knorr et al. in view of Chen et al.

Moreover, in an attempt to supply a rationale for combining Knorr et al. and Chen et al., the Official Action states, in the first full paragraph of Page 6:

Therefore, it would have been obvious to one [of] ordinary skill in the art at the time the invention was made to modify Knorr et al. by etching the conformal liner layer to recess the conformal liner layer relative to the device insulating layer adjacent thereto, to thereby defining [sic] the grooves as taught by Chen et al. to decrease the aspect ratio and increase reliability (col. 1, lines 48-62).

Applicants respectfully submit, however, that Knorr et al. Column 4, lines 52-62 state:

In one embodiment, first insulating material **116** comprises an oxide, and because a nitride liner 122 is used, an etch selective to nitride is preferably used. For example, a wet etch comprising buffered HF or other HF-based chemistries, or a dry isotropic etch, e.g. chemical downstream etching (CDE) using fluorine-based chemistries, may be used to remove the first insulating material **116** from the isolation trench **111** sidewalls, for example, when the insulating material **116** comprises SiO₂. Alternatively, a timed etch may be used. Approximately 5-50 nanometers of first insulating material **116** is preferably removed. (Emphasis added.)

Accordingly, Knorr et al. teaches away from removal of the liner **122**, so that it would not be obvious to combine Knorr et al. and Chen et al., to contradict the explicit teachings of Knorr et al.

Dependent Claims 2, 3, 12, 13, 15, 16 and 20 are patentable at least per the patentability of independent Claims 1 and 11, from which they depend. Moreover, dependent Claims 14 and 17-19 also are patentable at least per the patentability of the independent claims from which they depend. In view of the clear patentability of the

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independent claims, the separate patentability of these dependent claims will not be analyzed.

Conclusion

Independent Claims 1 and 11 have been amended to further clarify the patentable distinctions over Knorr et al. taken alone or in combination with the secondary references. Accordingly, Applicants respectfully request allowance of Claims 1-6 and 11-20 and passing the application to issue.

Respectfully submitted,



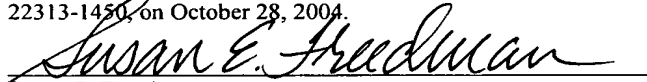
Mitchell S. Bigel
Registration No. 29,614
Attorney for Applicants

Customer Number 20792

Myers Bigel Sibley & Sajovec, P.A.
P.O. Box 37428
Raleigh, NC 27627
919-854-1400
919-854-1401 (Fax)

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